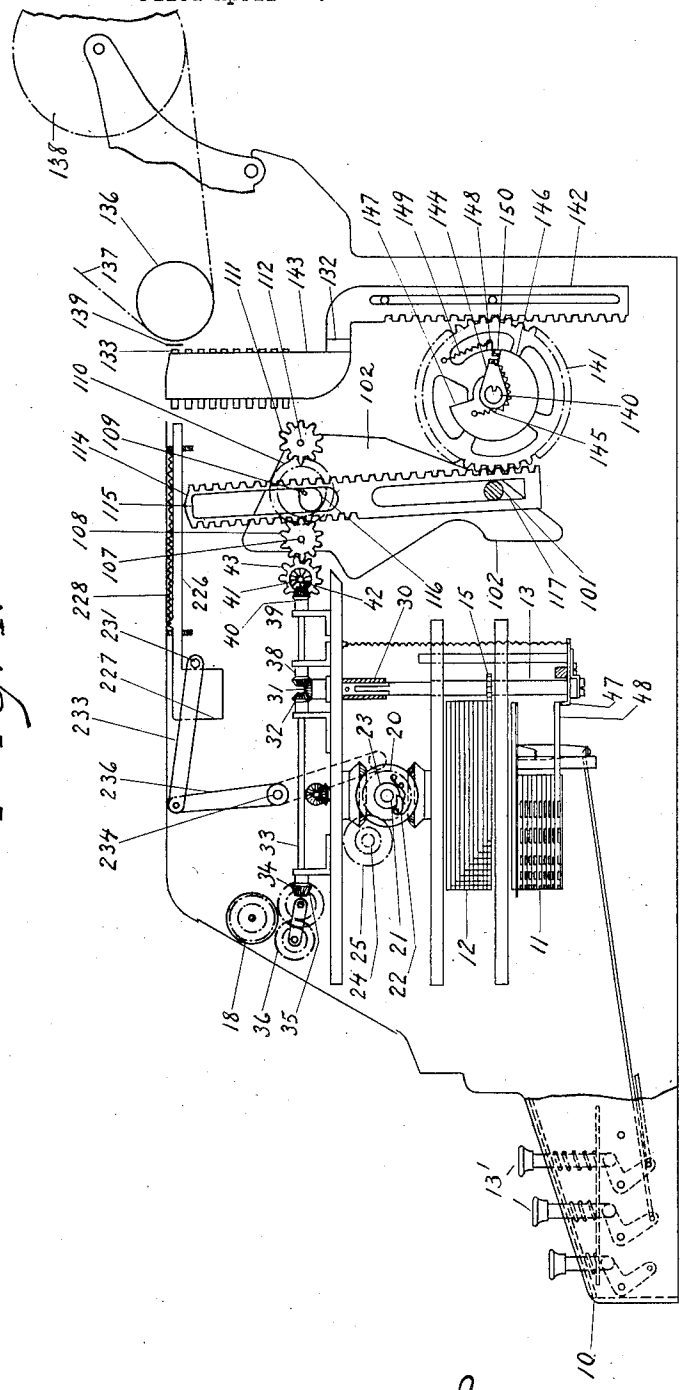
Nov. 29, 1932. C. LUTTROPP 1,889,023

CALCULATING MACHINE

Filed April 27, 1927 4 Sheets-Sheet 1

Fig. 1.



Inventor
Conrad Luttropp,
By Lemmy Atty

Nov. 29, 1932. C. LUTTROPP 1,889,023

CALCULATING MACHINE

Filed April 27, 1927 4 Sheets-Sheet 2

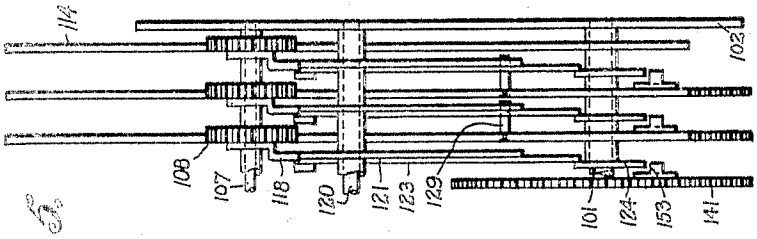


Fig. 5.

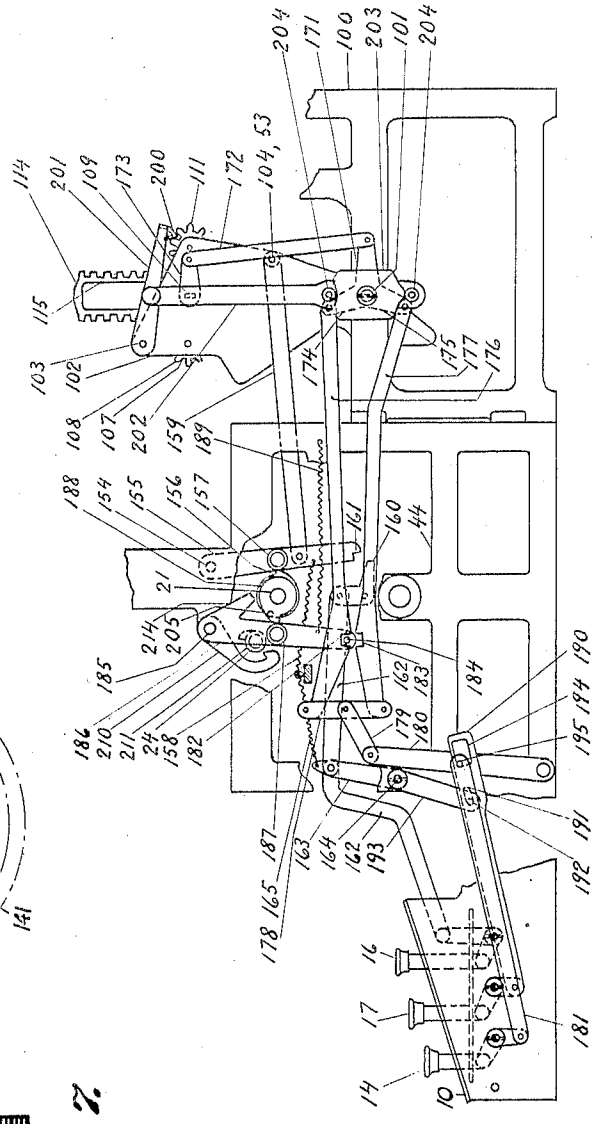
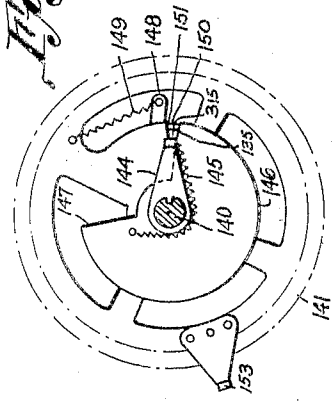


Fig. 2.

Fig. 6.



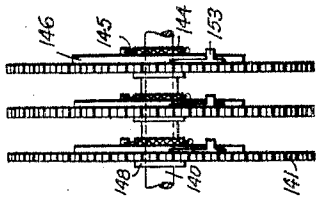


Fig. 7.

Inventor
Conrad Luttropp.
By Lemmon & Lemmon
Attys

Nov. 29, 1932. C. LUTTROPP 1,889,023

CALCULATING MACHINE

Filed April 27, 1927 4 Sheets-Sheet 3

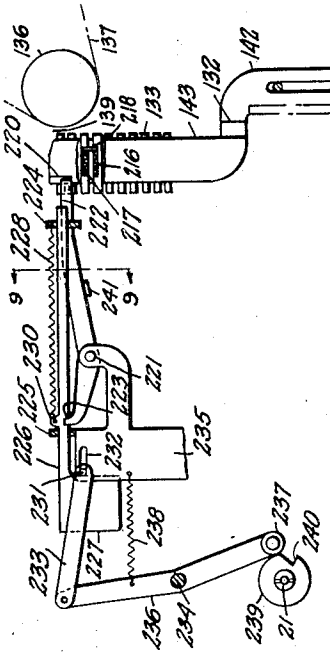


Fig. 8.

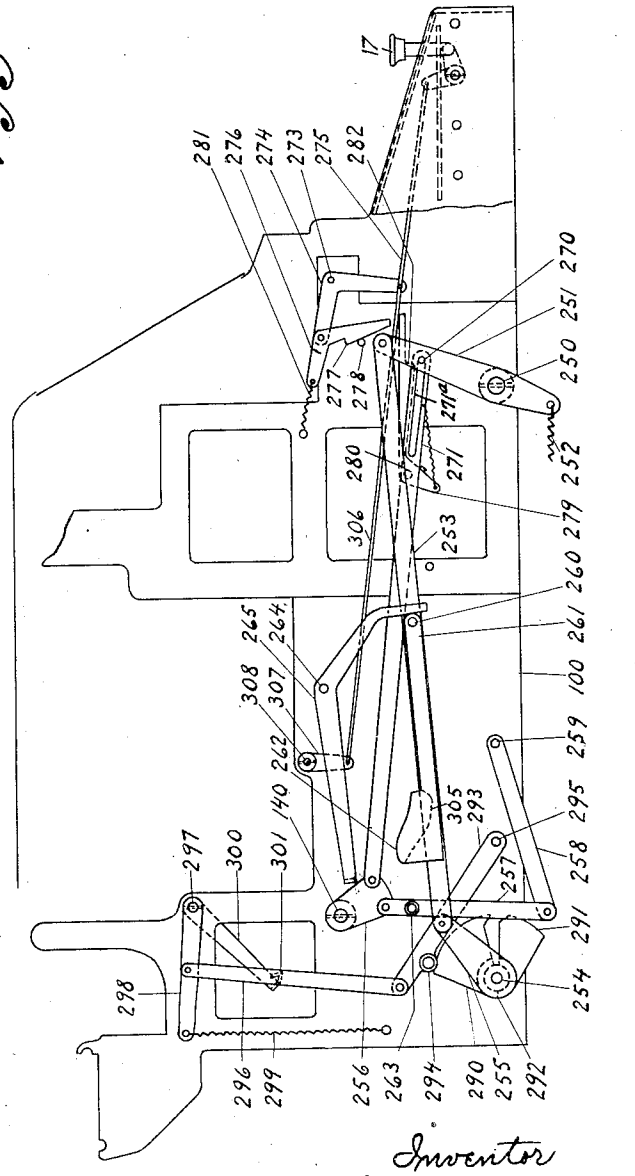


Fig. 3.

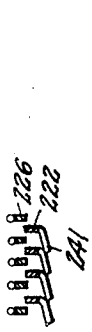


Fig. 9.

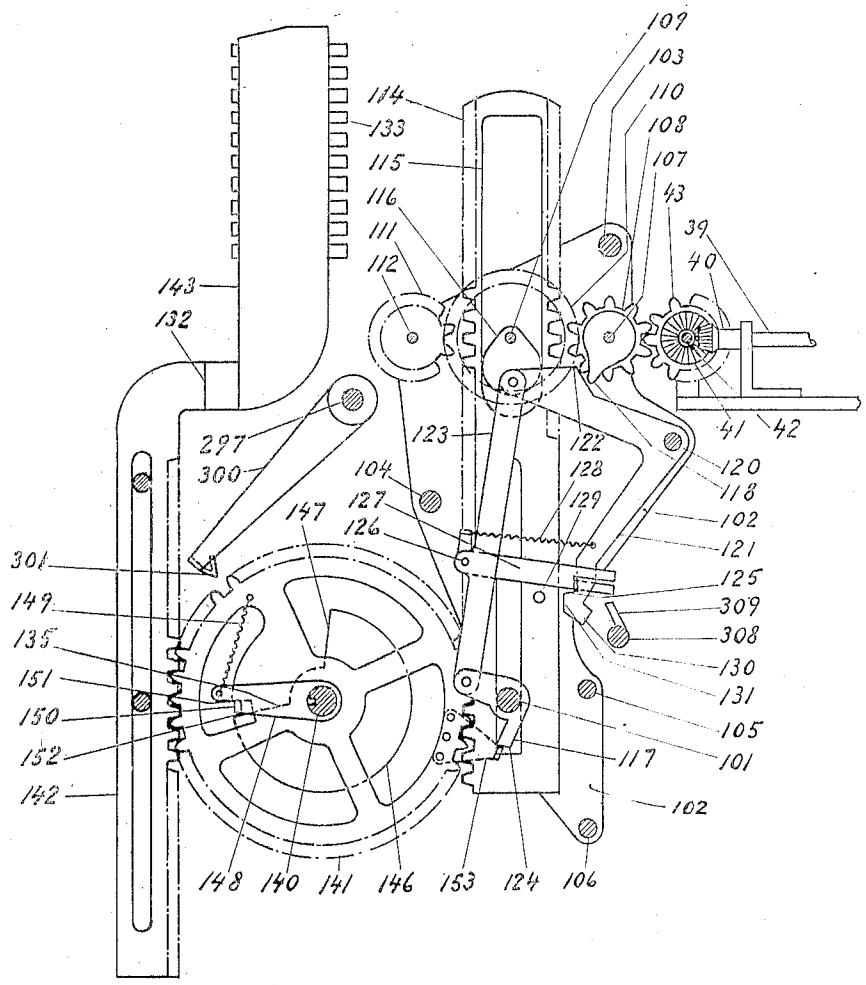
Inventor
Conrad Luttropp,
By [signature] Atty.

Nov. 29, 1932. C. LUTTROPP 1,889,023

CALCULATING MACHINE

Filed April 27, 1927 4 Sheets-Sheet 4

Fig. 4.



Inventor
Conrad Luttropp
By Lawrence & Co
Atty.

Patented Nov. 29, 1932 1,889,023

UNITED STATES PATENT OFFICE

CONRAD LUTTROPP, OF STOCKHOLM, SWEDEN, ASSIGNOR OF ONE-HALF TO ANDERS LINDAHL, OF STOCKHOLM, SWEDEN

CALCULATING MACHINE

Application filed April 27, 1927, Serial No. 187,090, and in Sweden March 9, 1927.

The present invention relates to calculating machines operated by a handle or crank shaft or equivalent general operator. The main object of the invention is to provide accumulating-recording mechanism for calculating machines which is simple in construction and reliable in action.

My invention will be understood by consideration of the following description and is defined in the appended claims.

The invention will be described as applied to a calculating machine of the type disclosed in my copending application, Serial No. 657,148, which has matured into Pat. No. 1,662,526, granted March 13, 1928, that is to say a calculating machine provided with a rotating selector and a rotatable item transfer drum (sometimes by me termed a counting drum), yet it should be noted that the invention is in no way limited to this type of calculating machines but may be applied to any ten-key-operated calculating machine.

In the accompanying drawings, I have shown one embodiment of my invention, as applied to a ten key calculator.

Figure 1 is a longitudinal section of the machine with certain parts omitted for the sake of clearness.

Fig. 2 is a side elevation of the machine as seen from the right hand side.

Fig. 3 is a side elevation of the machine as seen from the left hand side.

Fig. 4 is a side-elevation on an enlarged scale showing a unit of the accumulating-recording mechanism as seen from the left hand side of the machine.

Fig. 5 is a partial front elevation as seen from the right hand side in Fig. 4.

Fig. 6 is a side elevation of one of the intermediate gears of the accumulating-recording mechanism, as seen from the opposite side relatively to Fig. 4.

Fig. 7 is a top plan view of some of said intermediate gears.

Fig. 8 is a side elevation of the hammer mechanism of the printing device.

Fig. 9 is a section along the line 9—9 of Fig. 8.

In the following description and claims the expressions "right" and "left" refer to the machine as seen from the key board.

Referring to the drawings the main parts of the calculating machine proper comprise a key board 10 a selector 11 rotatable step by step forwards and backwards a drum 12 rotatable in either direction and spindles 13 co-operating with the selector 11 and the drum 12. The key board comprises ten item or digit keys 13′ corresponding to the digits 0 to 9, respectively, two keys for setting the machine for addition and multiplication or for subtraction and division, respectively, only one of said keys, the subtraction key 14, being shown on the drawings in Fig. 2, a non-print key 16 for setting the accumulating-recording mechanism out of operation, and a total key 17, by means of which the result of a counting operation may be obtained. Further the key board 10 comprises certain other keys (not shown) for the operation of the machine, but it is deemed unnecessary for a proper understanding of the present invention to describe such keys. Furthermore, the machine comprises a to and fro movable operating handle or other general operator, (not shown).

In brief, the selector 11 comprises groups of vertically disposed adjustable stops or tongues corresponding to the digit keys and set into operative position by the depression of said digit keys, while the selector is simultaneously rotated step by step. The spindles 13 are each provided with a stop 47 and carry a pinion 15 adapted to be acted upon by the drum 12, when the latter is rotated due to the operation of the handle. For locking the spindles 13, in their depressed, inoperative position, a flange ring 48 is provided. The drum 12 is provided with a plurality of toothed discs or mutilated gears disposed vertically above each other, which correspond in order to the different digits and are adapted to actuate the spindles 13, when released by flange 48, the movement being transmitted to the counting wheels 18 of the main counting register or indicating totalizer by means of suitable transmitting means so as to transmit the number as set up by the depressed keys and registered by the setting of the se-

lector 11 and the spindles 13, to said main counting register.

From the operating handle the movement is transmitted for instance by means of a gear sector (not shown) to the gear wheel 20 rotatably mounted on one of the main driving shafts 21 of the machine. The gear wheel 20 is connected with shaft 21 by means of a spring actuated pawl 22 secured to gear wheel 20 and a ratchet wheel 23 secured to the shaft 21 (see Fig. 1) so that the shaft 21 will perform one revolution when the handle is moved in one direction (forwards), whereas said shaft 21 will not be acted upon, when the handle is returned to its normal or idle position. Rotatably mounted on another driving shaft 24 is a gear wheel 25 engaging the gear wheel 20 and connected to the shaft 24 in similar manner to that described above with reference to the gear wheel 20 and the shaft 21, the arrangement being such that the shaft 24 is rotated one revolution, when the operating handle is returned to normal position, but will not be operated, when the handle is moved forwards.

Engaging the upper portion of each spindle 13 is a hollow or split sleeve 30 which is rotatably mounted in the frame 44 of the machine and engages the spindle 13 in a way such as to allow the latter to move axially relatively to the sleeve 30 but not to rotate in relation thereto. At its upper end, each sleeve 30 carries a bevel gear 31 from which the movement is transmitted on the one hand to the wheels 18 of the main counting register or indicating totalizer by means of the bevel gear 32, the shaft 33, the bevel gears 34, 35, and the intermediate wheel 36, and on the other hand to the accumulating-recording mechanism by means of the bevel gear 38, the shaft 39, and the bevel gears 40, 41 to a gear wheel 43 loosely mounted on a transverse shaft 42 journalled in the rear part of the calculating machine proper.

For purposes of terminology with respect to this patent, we may say that the parts so far described in more or less detail include selector mechanism, item transfer mechanism, and a totalizer. The selector mechanism in which the items are set up and the item transfer mechanism, which is actuated to transfer the items to other mechanism such as a totalizer, together form what may be termed "item mechanism". This includes the selector 11 and the parts including the keys 13′ which are operated to set up an item in the selector, and the item transfer mechanism which includes the rotatable drum 12, spindles 13 and the transmitting shafts and gears for transferring the items to the indicating totalizer (18) on the one hand and, on the other hand, the accumulating-recording mechanism which is actuated from gear 43, to be subsequently described in detail. The handle constitutes the initial element of the machine actuating mechanism.

An item is set up in the selector. The actuating mechanism, including the handle, operates the item transfer mechanism to transfer the items set up in the selector to the indicating totalizer (18) and the recording mechanism. For details as to the item mechanism and as to the totalizer including the wheels (18), reference may be had to my aforesaid Pat. No. 1,662,526.

The accumulating-recording mechanism is mounted in a frame 100, Fig. 2, removably secured to the main frame 44 of the calculating machine in any suitable manner, as for instance, by means of screws. Swingably mounted in the frame 100 by means of a shaft 101 is a structure hereinafter referred to as a "carrier". Said carrier comprises two end plates 102, 102 interconnected by means of a plurality of distance rods 103, 104, 105, 106, Fig. 4, and shafts. Rotatably mounted on a shaft 107 secured in the carrier is a series of gear wheels 108 in permanent mesh with another series of gear wheels 110 loosely mounted on another shaft 109 journalled in the carrier. Permanently engaging said last-mentioned series of gear wheels 110 is another series of gear wheels 111 loosely mounted on a shaft 112 secured in the carrier. The gear wheels 108 and 111 may be termed accumulator wheels. The gear wheels 108 are each provided with a projection 118. Guided between each of the gear wheels 110 and guiding discs (not shown) secured to the shaft 109 is a series of racks 114 provided with teeth on both sides. Each of said racks 114 is formed with an upper slot 115 and engaging said slot 115 is an eccentric 116 secured to the shaft 109. By means of said eccentrics 116 the racks 114 may be swung on the shaft 101 to engage either the gear wheels 108 or the gear wheels 111 according to the counting operation to be performed, as will be hereinafter described. The shaft 101 passes through a lower slot 117 formed in each rack 114 so as to permit said racks to move up and down. Each of the wheels 108 and 111 has ten teeth corresponding to the digits 0 to 9, respectively, and the wheels 108 and 111 are thick enough to permit the teeth thereon to simultaneously engage the intermediate wheels 110 and the racks 114 as well.

Rotatably mounted on shaft 120 secured in the carrier is a series of bell crank levers 121, one for each rack 114. Formed on the upper end of each lever 121 is a projection 122 co-operating with the projection 118 on the corresponding gear wheel 108. The end of the upper arm of each lever 121 is connected by a link 123 to one end of an angularly bent pawl 124 loosely mounted on the shaft 101. Said pawl serves to control the ten transfer operation in the accumulating-recording mechanism. At its other free

end, each lever 121 is formed with a notch 125 and engaging in said notch 125 with its one arm is a bell crank lever 127 (see Fig. 4) pivoted to the link 123 by a pin 126. The other arm of the lever 127 is connected to the bell crank lever 121 by means of a spring 128. When the projection 118 of the accumulator wheel 108 upon the rotation of said wheel in counter-clockwise direction, as seen in Fig. 4, strikes the projection 122 on the lever 121, the locking lever 127 is brought out of engagement with the notch 125 in the lever 121 and climbs a shoulder 131 on said lever 121, thus locking said lever 121 in this position. At its end engaging the lever 121 the locking lever 127 is fork-shaped to embrace the lever 121. Each rack 114 carries a pin 129 adapted upon the upward movement of the rack 114 to again bring the locking lever 127 into engagement with the notch 125. The bell crank lever 121 is further provided with a projection 130 at its free end to lock the lever when a total is printed, as will be hereinafter more fully described. Mounted in the frame 100 is a shaft 140 and loosely mounted on this shaft is a series of gear wheels 141 which each engage a separate one of the racks 114. Each of the gear wheels 141 also engages a row of teeth on a type bar 142 guided in a slot in the rear plate of the frame 100 and carrying a type head 143. In order to obtain the individual digits of the printed number in close position to each other the type arms 142 are angularly bent laterally at 132 so that the type heads 143 will lie side by side in close proximity to each other.

Mounted in each type head 143 are ten types 133 each carrying one of the digits 0 to 9, said digits being arranged in the order stated reckoned from the top downwards. Each type 133 comprises a little rod situated in the longitudinal direction of the machine, which is slidably mounted in a through-extending opening in the type head and carries at its one end the respective digit and projects at its other end a distance beyond the type head 143. Each type rod 133 is provided with a longitudinal groove 216, Fig. 8, and housed in said groove is a spring 217, the one end of which is secured to the respective type 133, whereas the other end is secured to a stop 218 provided within the type head as seen in Fig. 8.

Extending transversely over the row of type heads 143 is a printing roller 136 adapted by means of suitable mechanism (not shown) to feed the roll step by step. Engaging said roller 136 is a paper strip 137 from the paper supply roller 138. Arranged between the printing roller 136 and the type heads 143 is a color ribbon 139 which is moved a step by any suitable means after each printing operation. The means for effecting the stepwise movement of the printing roller and of the color ribbon do not form any part of the present invention and will, consequently, not be described in detail.

Each intermediate wheel 141 co-operates with a catch member 144, Fig. 6, secured to the shaft 140. Each member is provided at its outer end with a lateral extension or stop 315. For each intermediate wheel there is, furthermore, an individual limiting disk 146 loosely mounted on said shaft 140 and provided with a sector-shaped notch limited by the surfaces 135 and 147. Each catch member 144 is connected to its respective limiting disc 146 by means of a spring 145 tending to hold said disc 146 with one limiting surface, 135, of the notch in engagement with the stop 315. The center angle of the sector-shaped notch of the disc 146 corresponds to nine teeth of the wheel 141 and, consequently, also to nine teeth of the rack 114 and of the type arm 142 as well, to permit each loose wheel 141 to move any number of digits up to nine without moving its corresponding disc 146 which is spring held to the shaft 140. Loosely mounted on the shaft 140 at the opposite side of each intermediate wheel 141 to said disc 146 is an arm 148 connected by means of a spring 149 to the wheel 141. At its free end each of said arms 148 is formed with an abutment 150 extending through an opening in the wheel 141 larger than the abutment, and normally pressed by spring 149 against one side of the opening at 151, Fig. 4. The abutment 150 serves as a limiting stop for the disc 146 in the rotation of the latter in either direction, the disc striking said abutment 150 with either of the surfaces 135 or 147. Against the action of spring 149 the arm 148 may be rotated by the limiting disc 146 through an angle corresponding to at least one tooth of the toothed wheel 141, the rotation of said arm 148 in the opposite direction being limited by the abutment 150 striking the opposite side of the opening in the wheel 141 at 151. Departing from the position of the parts 141, 144, 145, 146, 148 and 149 shown in Figs. 4 and 6, the limiting disc 146 may be rotated in clockwise direction (Fig. 6) by the catch member 144 and its stop 315 during the first nine steps after which it strikes the abutment 150 with its surface 147, and then, as above described, through a further angle, corresponding to one tooth against the action of the spring 149, the disc 146 being movable in the opposite direction an angle corresponding to nine teeth by the action of the spring 145. This arrangement will be more clearly described in connection with the description of the operation of the accumulating-recording mechanism.

Each gear wheel 141 is formed with a projection 153 extending beyond the periphery of the wheel in a direction at right angles to the plane thereof. The gear wheels 141 with

associated elements are disposed in a row on the shaft 140, so that the projection 153 of any toothed wheel 141, when in normal position, will abut against the pawl 124 of the rack 114 lying nearest to the right.

The transfer of items to the recording mechanism is accomplished as follows:—

As stated above, the carrier is swingably journalled in the frame 100 on the shaft 101 and comprises a set of transverse connecting rods. One of said rods, 104, terminates in a pin 53, Fig. 2, on which one end of a link 159 is rotatably mounted. The other end of said link 159 is pivoted to an arm 155 swingably mounted in the frame 44 at 154. Secured to the driving shaft 21 is a cam 156 engaging a cam roller 157 on said arm 155. The arm 155 is operated by a spring 158 maintaining the roller 157 in permanent engagement with the cam 156. The cam 156 is of such a shape as to cause the cradle upon the forward rotation of the operating handle of the machine to first swing in clockwise direction, as seen in Fig. 2, whereby the accumulator wheels 108 are brought into engagement with the driving wheels 43, whereas the carrier is returned to normal with the wheels 108 out of engagement with the driving wheels 43, as soon as the forward stroke of the operating handle is completed, due to the cam 156 pressing the link 159 in opposite direction (to the right in Fig. 2) against the action of the spring 158.

The carrier may be locked in disengaged position with its wheels 108 out of engagement with the wheels 43, when it is desired not to operate the accumulating-recording mechanism, or when it is desired to print the result of a preceding counting operation, the integrating posts of which have been transmitted to the printing device and printed. The means for performing this operation comprises a pawl 160 co-operating with a notch 161 formed in the arm 155 and which may be operated under the control of two keys, that is the keys 16 and 17 of the keyboard 10, by the intermedium of the link 162, pivoted between its ends to the one end of an arm 163 secured to a rock shaft 164 journalled in the frame 44. By means of a spring 165 acting on the arm 163 the pawl 160 is normally held out of engagement with the notch 161 in the arm 155. The non-printing key 16 operates said link 162 directly in such a way that the depression of said key will cause the pawl 160 to lock the arm 155 whereas the total key 17, when depressed, operates a link 190 having a slot 191 formed in it engaged by a pin 192 on an arm 193 secured to the shaft 164. Either of said keys 16 or 17, when depressed, will be maintained in depressed condition by suitable means which as far as the total key is concerned will be hereinafter described. The locking of the arm by depressing any of said keys 16 or 17 will evidently also lock the carrier.

As stated above, the racks 114 may be caused to swing on the shaft 101 by means of the eccentrics 116. This swinging movement of the racks 114 may be controlled from the key board 10 in the following manner. Secured to the shaft 101 is a spider, having three arms, one, 171, of which is connected by means of a link 172 to one end of an arm 173 secured to the cam shaft 109 loosely mounted in the carrier. The other arms of the spider 174 and 175 are each connected by means of a link 176 and 177, respectively, to a cross-piece 178 which is adapted to be operated through the intermedium of a toggle lever 179, 180 on the one hand from the subtraction key 14 (and, of course, also from the addition key which, however, is not shown) by means of a link 181, on the other hand from the total key 17 by means of a link 190. The link 181 is pivoted at 195 to the toggle arm 180, whereas the link 190 is formed with a slot 194 engaged by the pin 195. The slots 191 and 194 in the link 190 serve to permit the movement of the links 181 and 190 independently of one another.

Each of said links 176 and 177 is formed with with a notch 182 and 183, respectively, co-operating with a pin 184 secured to one end of an arm 186 pivoted to the frame 44 at 185. The arm 186 carries a rotatable roller 187 co-operating with a cam 188 secured to the driving shaft 21, said roller 187 being held in permanent engagement with said cam 188 by means of a spring 189 having its one end secured to the arm 186 and its other end secured to the frame 44.

In Fig. 2 which shows the transmitting means above described, the machine is shown as set for addition and multiplication, in which case the pin 184 engages the notch 182 in the link 176. When the shaft 21 is rotated clockwise, as seen in Fig. 2, due to the operating handle being rotated forwards, the cam 188 first permits the arm 186 to be moved to the right, as seen in the same figure, to cause the pin 184 to move the link 176 to the right so as to turn the spider 171, 174, 175, in clockwise direction. The link 172 is now drawn downwards, whereby the shaft 109 journalled in the cradle will be rotated clockwise by the arm 173, so that the racks 114 are swung to the left into engagement with the toothed wheels 108 by the action of the eccentrics 116 (all seen in Fig. 2). In Fig. 4 which shows the accumulating-recording mechanism as seen from the opposite side as in Fig. 2, the directions of movement will, of course, be reversed.

When the link system 176, 177 on depressing the total key 17 or the subtraction key 14 is moved upwards, so as to bring the notch 182 in the link 176 out of engagement with the pin 184 and bring the latter into engagement with the notch 183 in the link 177, said movement being transmitted by

the toggle lever 179, 180 and either of the links 181 and 190, the link 177 upon the movement of the operating handle in forward direction will be operated similarly, causing the spider 171, 174, 175 to rotate in the opposite direction and bringing the racks 114 into engagement with the toothed wheels 111 instead of the toothed wheels 108. At the completion of the forward stroke of the operating handle the racks 114 are again brought out of engagement by means of cam 188, roller 187, arm 186, pin 184, link 177 or 176, spider 171, 174, 175, link 172, arm 173, and the eccentrics 116 secured on the shaft 109.

The position of the pin 184 in engagement with either of the notches 182 and 183 is determined by the position of the toggle device 179, 180 and this depends in turn upon the counting operation to be performed. In the embodiment shown the pin 184 occupies the position shown in Fig. 2, that is, in engagement with the notch 182 in the link 176, when performing addition or multiplication, whereas in case of subtraction or division as well as when a total result of a counting operation is to be printed, the toggle lever 179, 180 is straightened by the action of the link 181 or 190, thereby causing the notch 183 in the lower link 177 to be engaged by the pin 184. In the former case the racks 114 are swung into engagement with the accumulator wheels 108, in the latter case with the accumulator wheels 111.

In order to assure that the link 176 or 177 is positively actuated by the arm 186 and the pin 184, even if the operation of the spring 189 should fail, the arm 186 is provided with a projection 214 co-operating with a pin 205 on the cam 188, whereby the link 176 or 177 is positively moved in the proper direction, as soon as the pin 205 strikes the projection 214 during the rotation of the cam 188.

Rigidly secured to the pivot pin 185 of the arm 186 is another arm 210 co-operating with a cam 211 secured to the driving shaft 24. As stated above, the shaft 24 is only rotated upon the return movement of the operating handle, but is left unoperated upon the forward stroke of said handle. In the return stroke of the handle the shaft 24 is rotated in clockwise direction, as seen in Fig. 2, causing the cam 211 to rotate the arm 210 in the same direction against the action of the spring 189, bringing with it the arm 186, the roller 187 of which is released from contact with the cam 188 on the highest point of which it has previously rested.

As a result, the link 176 or 177 in engagement with the pin 184 will be moved in a direction opposite to that during the forward stroke of the operating handle, that is, the racks 114 will swing into engagement with the toothed wheels 111, if on the forward stroke of the handle they were brought into engagement with the toothed wheels 108, and vice versa. The significance of this operation will be described hereinafter in connection with the description of the operation of the accumulating-recording mechanism.

In order to prevent an intentional or unintentional movement of the gear wheels 108, 111, after they have once been set, a transverse locking beam 200 Fig. 2 is arranged above the gear wheels 111 loosely journalled on the shaft 112. Said locking beam 200 is adapted to engage said gear wheels 111, when the racks 114 are out of engagement with the wheels 108 or 111. The locking beam 200 is swingably mounted by means of arms 201 on the distance rod 103 in the carrier, and each of the arms 201 co-operates by means of a link 202 and rollers 204, 204, rotatably mounted thereon with a cam 203 secured to the shaft 101. Said cam 203 is of such a shape that, when the shaft is rotated in the one direction or the other by means of the spider 173, 174, 175, and either of the links 176 and 177, the locking beam 200 will be lifted out of engagement with the gear wheels 111 and again brought into engagement therewith as soon as the shaft 101 is returned to normal by means of the link system.

The printing mechanism comprises the following means (see Figs. 8 and 9). Formed in the top of each type head 143 is a notch 220 engaged by one end of a locking lever 222 swingably mounted at 221 on a frame 235 removably attached to the machine frame, said printing mechanism frame 235 being shown in part only in Fig. 8. The locking lever 222 engages with its other end, a notch 223 formed in the lower side of a hammer 226 disposed in front of the respective type head and which is movably journalled in guide plates 224 and 225 mounted in the frame of the machine. At its end facing the key board 10 each hammer 226 carries a weight 227. A spring 228 secured at its one end to the bearing 224 and at its other end to the hammer 226 at 230 tends to move the hammer towards the type head 143.

Disposed in front of all of said weights 227 is a retracting rod 231 guided at both ends in a slot 232 in the frame 235 and connected by means of a link 233 to one end of a lever 236 pivotally mounted in the frame 235 at 234. At its other end said lever 236 carries a roller 237 which by a spring 238 is held in engagement with a cam 239 secured to the driving shaft 21. The shape of said cam 239 is such as to cause the roller 237 at the end of the forward stroke of the operating handle to drop into engagement with a notch 240 of the cam 239, thereby allowing the arms 233 and the rod 231 under the action of the spring 238 to be suddenly moved forwards to release the hammers 226 with their weights 227, so that those hammers 226 which are not locked by their respective locking levers 222 will strike the types 133 of the respective type

heads 143, thereby effecting the printing of said types on the paper strip 137.

If the machine is viewed from the rear side each locking lever 222 counted from the right engages with the locking lever 222 lying next to the left by means of a projection 241 extending at an angle to the locking lever 222 and engaging the locking lever 222 lying next to the left as shown in Fig. 9. The position of the type heads 143 is such that in the normal position, the digit 0 thereof is situated in register with the respective hammer 226. The arrangement just described has for its object to permit the printing of zeros, when any number containing a zero or zeros is to be printed. Assuming for instance, the number 100 is to be printed, the third from the right of the type heads 143 is set on the digit 1 in a manner to be described hereinafter. At the same time that the locking lever 222 for the hammer 226 corresponding to said type head 143 is released due to the type head being lifted a distance corresponding to one tooth, the locking levers 222 for the two hammers 226 lying to the right of said third hammer are also released by the action of the projections 241 so that on the following printing operation not only the third hammer but also the first two hammers are free to act upon the corresponding type heads to print the number 100 on the paper strip 137.

For tens transfer as well as for obtaining a total result of a counting operation the accumulating-recording mechanism is operated by the following means. Journalled in the frame 44 is a shaft 250 connected by means of a pinion (not shown) to a gear wheel (not shown) on the shaft of the operating handle so that on operating said handle the shaft 250 will be rotated in a direction opposite to that of the handle shaft. Secured to said shaft 250 is a lever 251, one arm of which is connected to the machine frame 44 by means of a spring 252 adapted to effect the return of the handle to normal position, whereas the other arm of said lever 251 is connected by a link 253 to the end of an arm 255 secured on a shaft 254 journalled in the frame 100 at the rear of the machine. Secured to the shaft 140 likewise journalled in the frame 100 is an arm 256 connected by a link 257 to another link 258 pivoted in the frame 100 at 259. Pivoted to link 253 at 260 is an arm 261 provided at its free end with a cam-shaped portion having two cam surfaces, viz: an upper one 262 and a lower one 305. In normal position, the arm 261 rests with a plane surface on the link 253. The cam shaped portion 262, 305 is adapted upon the operation of the handle to engage a cam roller 263 mounted on the link 257, the arrangement being such that when in the forward stroke of the handle the lever 251 on the shaft 250 is rotated in counter clockwise direction, as seen in Fig. 3, to thereby move the link 253 to the left, the cam surface 305 will slide over the roller 263 without operating same, whereby the arm 261 is lifted. In the continued movement of the handle the arm 261 is allowed to drop by its own weight into engagement with the link 253. When the handle is returned, the roller 263 as well as the link 257 will be lifted by the cam surface 262, thereby moving the arm 256 in counter clockwise direction, as seen in Fig. 3, causing the shaft 140 and the parts carried thereby to rotate in the same direction for the purpose to be hereinafter described. In order to cause the return movement of the shaft 140 to normal position a bell crank lever 265 is journalled on the machine frame 100 at 264. On the return stroke of the operating handle, after the cam surface 262 has released the roller 263, one arm of said bell crank lever 265 will be acted upon by the pin 260, causing the other arm of said lever to depress the arm 256 thereby returning the shaft 140 to normal position.

The arm 251 further carries a pin 270 engaging a slot 271[a] formed in a link 271 near one end thereof, the other end of said link being secured to the arm 256. Journalled in the machine frame 44 by means of the pin 273 is a bell crank lever 274, one arm of which is connected by means of a link 275 to the total key 17, whereas the other arm of said lever is connected to a pawl 276 having a tooth at 277. By means of a spring 281 the lever 274 and the pawl 276 are maintained in the position shown in Fig. 3. Furthermore, the catch lever 274 is connected by means of a link 306 to the free end of an arm 307 secured to a shaft 308 journalled in the machine frame 100. Secured to the shaft 308 is a locking beam 309, Fig. 4, adapted, when the total key is depressed, to lock all of the levers 121 of the printing device for the purpose to be hereinafter described.

On depressing the total key 17 the tooth 277 of the pawl 276 is brought into engagemen with a pin button 278 secured to the frame 44. At the same time the end of the pawl 276 engages another pawl 279 shaped as a bell crank lever which is pivoted to the link 271 at 280, said other pawl having at its end a tooth 282 which is now moved downwardly to a position in front of the pin 270 thereby locking the link 271 to the arm 251. With the total key not depressed the movement of the arm 251 is transmitted to the arm 255, as described above, by means of the link 253. In this movement the pin 270 slides in the slot 271[a] in the link 271. With the total key depressed the operation of the handle will effect movement of the link 253 in the same direction as before, the cam surface 305 passing over the roller 263. At the same time the arm 256 and, consequently, also the shaft 140 is moved in clockwise direction, as seen in

Fig. 3, by means of the link 271. On the return stroke of the handle the link 271 rotates the arm 256 and the shaft 140 in the opposite direction, until the cam surface 262 comes into contact with the roller 263, whereupon the rotation of the shaft 140 in counter clockwise direction will continue by means of the arm 256 and the link 257. As soon as the connecting pin 260 in the continued return stroke of the handle strikes one arm of the bell crank lever 265, the shaft 140 is returned to normal.

Furthermore means are provided to effect an adjustment of the position of the gear wheels 141, so that the teeth of said wheels will lie in alignment with each other. Arranged on the shaft 254 is a cam sector comprising two parts 290, 291, one of which, 290, is secured to said shaft 254, whereas the other part 291 is loosely journalled on said shaft. The parts 290, 291 of the cam sector cooperate in such manner that in the normal position the part 291 loosely mounted on shaft 254 bears at one side of said shaft against the part 290 secured to the shaft 254, in which position a free space is left between the two parts at the opposite side of the shaft 254 into which space a roller 294 mounted on a link 293 may drop at a given moment during the forward stroke of the operating handle, after said roller 294 has slid upon the circumference of the part 290 secured to the shaft 254. In the continued forward movement of the handle the roller 294 will slide up on the circumference of the loosely mounted part 291. In the return stroke of the handle, the loosely mounted part 291 will be retained by the roller 294 due to friction against the latter, until no space remains between the parts 290 and 291, whereupon the roller 294 will slide up on the fixed part 290. The link 293 is pivoted at its one end to the frame at 295 and is connected at its other end to an arm 296 in turn connected to an arm 298 journalled in the frame 100 by means of the pin 297, the free end of said arm 298 being connected to the frame 100 by means of a spring 299. Secured to the shaft 297 at each side of the machine is an arm 300, and these two arms are connected to each other at their ends by means of a beam 301. As soon as the roller 294 during the forward stroke of the operating handle drops into the space between the two parts 290, 291 of the cam sector, the beam 301 will be moved into engagement with the wheels 141 under the action of the spring 299, thereby adjusting said wheels in such a manner that the teeth of the various wheels will be in exact alignment. When roller 294, during the continued forward movement of the handle, slides up on part 291, beam 301 is moved out of engagement with the wheels 141 against the force exerted by spring 299.

The operation of the accumulating-recording mechanism above described is as follows, assuming that the number 8 should first be set up and printed and then the number 4 added thereto. It should first be observed that the addition key is depressed. Then the key 13′ on the key board 10 corresponding to the digit 8 is depressed, whereby the ninth tongue counted from below of the first vertical group of tongues of the selector 11 is pressed out. At the same time the selector 11 is moved one step in counter clockwise direction, as seen from above. The first group of tongues is now in alignment with the first spindle 13. The operating handle is now moved forwards. This releases said first spindle 13 which has been locked like the other counting spindles by the flange ring 48 and moves this ring past the spindle, and said spindle is now drawn upwards due to spring action, until the disc 47 fixed on said spindle strikes the selected tongue in the first group of tongues of the selector 11. By this means the operative counting spindle 13 is set in such a position as to have its pinion 15 in alignment with the eighth toothed disc of the counting drum 12, counted from below preparatory to be rotated thereby. The other counting spindles 13 remain in their normal position locked by the flange ring 48 of the selector 11.

The movement of the operating handle in the forward direction being continued the counting drum 12 is rotated one revolution counter clockwise as seen from above, thereby allowing the counting spindle set to be operated by the counting drum 12 so as to rotate through an angle corresponding to eight teeth, that is, to the set up digit 8, said movement being transmitted to the counting wheels 18 of the main counting register or totalizer by means of the sleeve 30, the gear wheels 31, 32, the shaft 33, the gear wheels 34, 35, and the intermediate wheel 36, which latter wheel has been brought into engagement with the counting wheel 18 in the main counting register simultaneously with the upward movement of the counting spindle 13 against the operative tongue in the selector 11. At the same time the digit 8 set up is also transmitted to the wheel 43 by means of gear wheels 31, 38, shaft 39, and gear wheels 40, 41, whereby the gear wheel 43 secured to the wheel 41 is rotated through an angle corresponding to eight teeth, that is, to the digit 8 set up.

When it is desired to print the number set up, the carrier 102, however, has been swung during the forward stroke of the handle in such a direction that the accumulator wheels 108 have been brought into mesh with the driving wheels 43. This movement is effected by means of link 159, arm 155, roller 157, spring 158, and cam 156 secured to the driving shaft 21. On the forward stroke of the handle the racks 114 have also been thrown

into engagement with the toothed wheels 108. Said last-mentioned movement is effected by means of the eccentrics 116, shaft 109, arm 173, link 172, spider 171, 174, 175, link 176, pin 184, arm 186, roller 187, and the cam 188 secured to the driving shaft 21. Consequently, before the set position of the spindles 13 is transmitted to the driving wheels 43, the accumulator wheels 108 have been brought into mesh with the driving wheels 43 due to the swinging movement of the cradle and, furthermore, the racks 114 have been brought into engagement with the accumulator wheels 108 due to their swinging movement about the shaft 101. In transmitting the movement to the first driving wheel 43, the first gear wheel 108 will, consequently, also be rotated eight teeth corresponding to the digit set up, causing the rack 114 engaging said wheel 108 to be moved downwards a distance corresponding to eight teeth. The rack 114 is in permanent mesh with the gear wheel 141, and consequently, also the wheel 141 will be rotated an angle corresponding to eight teeth, causing the type bar 142 which is in permanent engagement with the wheel 141 to be moved upwards a distance corresponding to eight teeth. The corresponding type head 143 will thereby occupy such a position that the type carrying the digit 8 comes to stand in register with the hammer 226. When the type bar 142 is moved upwards, the corresponding locking lever 222 previously engaging the notch 220 in the type head 143 will be turned about the shaft 221 so as to bring its other end out of engagement with the notch 223 in the hammer 226. The type head 143 can now freely pass the fore end of the locking lever 222. The hammer 226 thus operated is, consequently, free, whereas the other hammers 226 remain locked by the corresponding locking lever 222. At the completion of the forward stroke of the operating handle the stop rod 231 will be suddenly moved to the right in Fig. 8 by means of the spring 238, the cam 239 secured to the driving shaft 21, the roller 237, and the arm 233 due to the roller 237 engaging the notch 240 in the cam 239, thereby releasing the hammers 226 from the rod 231. The hammer 226 which in the example given is released by the locking lever 222 and which is situated furthest to the right will now strike the type rod 133 carrying the digit 8 lying in register with said hammer, so as to print the digit 8 on the paper strip 137. The remaining hammers 226 remain in their locked position by the respective locking levers 222. At the end of the forward stroke of the handle the stop rod 231 returns those hammers 226 which have been in operation, in the case under consideration only the hammer furthest to the right, due to the roller 237 leaving the notch 240 in the cam 239 upon the continued rotation of the shaft 21. The type arm 142 having been returned to normal position in a manner hereinafter described, the locking lever 222 will again engage the notch 220 in the type head 143 and the notch 223 in the hammer 226 as well, thus again locking the latter in normal position.

As soon as the handle has completed its forward stroke the carrier is returned to normal position under the control of link 159, arm 155, roller 157, cam 156 secured to the driving shaft 21, and spring 158. Likewise, the rack 114 is brought out of engagement with the gear wheel 108 by means of the spring 189, the cam 188 secured to the driving shaft 21, roller 187, arm 186, pin 184, link 176, spider 171, 174, 175, link 172, arm 173 secured to the shaft 109, and the eccentrics 16 also secured to said shaft. Upon the return stroke of the handle the shaft 140 is rotated counter clockwise, as seen in Fig. 3, by means of the arm 251 fixed on the shaft 250, the link 253, the arm 261, the cam surface 262, the roller 263, the link 257 and the arm 256 secured to the shaft 140. With the gear wheels 141 in normal position the projection 153 bears against the pawl 124 of the rack 114 lying furthest to the right, and furthermore the disc 146 bears against the abutment 150 with one, 135, of the surfaces limiting the notch therein. On the movement of the rack 114 upon the printing of the number set up, the wheel 141 is rotated, in turn operating the stop arm 148 with its abutment 150, which is rotated through an angle away from the surface 135 of the notch in the disc 146 corresponding to the digit 8 set up. During this movement, however, the disc 146 retains its position on the stationary shaft 140. When the shaft 140 is rotated upon the return stroke of the handle, the catch member 144 is also turned bringing with it the disc 146 connected to said catch member 144 by means of the spring 145. At all unoperated wheels 141 the discs 146 can be turned the necessary angle corresponding to nine teeth, before the other surface 147 of the notch in the discs 146 strikes the abutment 150, but at those wheels 141, however, which have been operated in connection with the setting up of the number to be printed, that is to say, in the given example, the wheel 141 lying furthest to the right, the disc 146 following the rotation of the shaft 140 through an angle corresponding to one tooth will strike the abutment 150 on the wheel 141 and will, as a result, upon the continued rotation of the shaft, move the gear wheel 141 to return the same together with the rack 114 and the type arm 142 as well into normal position. When at the end of the return stroke of the handle the pin 260 strikes the bell crank lever 265, and the shaft 140 by means of said lever 265 is returned into normal position, all of the discs 146 are returned to normal by the respective catch

members 144 with the surface 135 in contact with the abutment 150. The machine is now restored to normal position.

Assuming the key of the key board 10 corresponding to the digit 4 is now depressed, the movement will be transmitted to the driving wheels 43 in the same manner as above described. Before the movement is transmitted to said wheels 43, the gear wheels 108 and the racks 114 have again been brought into engagement with the wheels 43. The wheel 43 lying furthest to the right is rotated an angle corresponding to four teeth and rotating with it the toothed wheel 108 the same number of teeth, said last-mentioned wheel 108 moving, in turn, the rack 114 downwards a distance corresponding to four teeth. The transmission of the movement to the type bar 142 is effected in the manner described above as is also the printing. On the paper strip 137 I have thus obtained the digits 8 and 4 vertically one under the other. The restoration to normal position takes place in the manner described above.

In order now to obtain the sum of the digits 8 and 4 a tens transfer must have taken place in the accumulator wheels 108, and this operation is as follows: The wheel, having been set for the number 8, is in such a position that the projection 118 of the wheel 108 still has to be stepped one tooth in the same direction as before to strike the projection 122 of the locking lever 121. On the rotation of the wheel 43 to set up the number 4, the projection 118 of the gear wheel 108 lying furthest to the right will be brought into engagement with the projection 122, as soon as said wheel 108 has gone through an angle corresponding to one tooth. In the continued rotation of the wheel 108 the projection 118 operates the projection 122 of the locking lever 121, to rotate the latter in counter clockwise direction as seen in Fig. 4, thereby turning the pawl 124 by means of the link 123 in the same direction. The lever 121 is locked in this position by the locking mechanism above described, in as much as the locking lever 127 mounted in the carrier has left the notch 125 in the lever 121 under the action of the spring 128 and in its downward movement has ridden up on the shoulder 131. Then the projection 118 is free to pass beyond the projection 122, so that the rotation of the gear wheel 108 through an angle corresponding to the remaining three teeth can be completed. At the same time the rack 114 will take its remaining three steps.

In the forward stroke of the operating handle the arm 251 is rotated in a direction opposite to that of the handle, the link 253 and the arm 261 journalled thereon being then moved to the left in Fig. 3. As described above, in such operation the cam-shaped part 262, 305 passes over the roller 263 without moving same. The cam-shaped portion 262, 305 having passed the roller 263, the arm 261 will by its own weight drop into its normal position in contact with the link 253. At the same time the operating handle has reached the end of its stroke, the cradle as well as the racks 114 have been moved into disengaged position, as described above. Upon the return stroke of the operating handle the link 253 together with the arm 261 is moved to the right in Fig. 3, the cam surface 262 thereby passing under the roller 263 in contact with same so as to lift the link 257, causing the arm 256 and the shaft 140 to be rotated counter clockwise, as seen in the same figure. At the beginning of the rotation of the shaft 140 all of those gear wheels 141 which have not been operated, that is to say in the example given, all of the gear wheels 141 except that lying furthest to the right, will occupy a position in which the limiting discs 146 bear with their surface 135 against the abutment 150, whereas that gear wheel 141 lying furthest to the right together with its respective abutment 150 will be an angle corresponding to four teeth remote from said surface 135, as is described above in connection with the description of the transmission of the number 8 to the printing device. When the shaft 140 is rotated the limiting discs 146 will be rotated in the same manner as before by means of the catch members 144. In this operation all of the discs 146 except that lying furthest to the right can be rotated the necessary angle corresponding to nine teeth, before striking the abutments 150 and consequently, the corresponding gear wheels 141 will not be rotated. On the contrary, the gear wheel 141 lying furthest to the right will be operated, when the shaft 140 and the disc 146 have been rotated through an angle corresponding to five teeth. The gear wheels 141 when in normal position bear with their projections 153 against the pawl 124 of the rack unit lying next to the right, their continued rotation being thereby prevented. In the example given, the pawl 124 of the rack 114, lying furthest to the right, however, has been turned counter clockwise, as seen in Fig. 4, when the projection 118 of the corresponding wheel 108 passed over the projection 122 of the locking lever 121. Due hereto the second gear wheel 141 as counted from the right can be stepped one step by means of corresponding limiting disc 146 and catch member 144 against the action of the spring 149. Said gear wheel 141 cannot be stepped more than one tooth, because the projection 153 will then strike the center of the pawl 124. During the return stroke of the operating handle and at the same time that the projections 153 of the gear wheels 141 strike said pawls 124, the racks 114 have been moved into engagement with the gear wheel 111, said movement being transmitted by means of

the link 176, the pin 184, the arm 186, the arm 210, and the cam 211 secured to the driving shaft 24. The additional step of the second toothed wheel 141, as counted from the right, which wheel 141 has been adjusted for tens transfer, is transmitted by means of the corresponding rack 114, the toothed wheel 111, and the intermediate wheel 110 to the second accumulator wheel 108 as counted from the right, said wheel 108 being, consequently, rotated an angle corresponding to one tooth. The tens transfer is now completed. As soon as upon the rotation of the shaft 24 in clockwise direction, as seen in Fig. 2, in the return stroke of the handle the arm 210 under the action of the spring 189 leaves the highest portion of the cam 211 secured to said shaft 24, the racks 114 are brought out of engagement with the toothed wheels 111 and moved into released position. The return of the parts into normal position takes place in the same manner as described above in connection with the restoration of shaft 140 through the intermedium of the bell crank lever 265. The machine is now again in its normal position, and in the accumulator the wheel 108 furthest to the right is set on 2, whereas the second wheel 108 as counted from the right is set on 1.

When it is desired to print the sum of the numbers 8 and 4 thus set, this is effected directly without any idle stroke merely by operating the handle, after the total key 17 has been depressed. Upon depression of the total key 17 the following functions take place: The bell crank lever 274 is turned counter clockwise, as seen in Fig. 3, and is locked by the tooth 277 on the hook 276 engaging the pin 278 on the frame. The rotation of the arm 274 rotates the arm 307 by means of the link 306 in the same direction causing the locking beam 309 to engage the projections 130 so as to lock all of the locking levers 121. When the arm 274 is turned the bell crank lever 279 is likewise turned, causing the tooth 282 to lock the link 271 to the lever 279. Furthermore, the depression of the total key causes the link 177 to engage the pin 184 which has before been in engagement with the link 176, that is to say, the machine is set for subtraction, so that the racks 114 in their following rotation will be brought into engagement with the gear wheels 111. This function is effected by the link 190, the toggle lever 179, 180, and the cross piece 178. Finally, the depression of the total key also locks the arm 155 through the actuation of the link 190, the arm 193, the arm 163, the link 162, and the pawl 160 which engages the notch 161 in the arm 155.

When the operating handle is turned forwards, the racks 114 are moved into engagement with the gear wheels 111 by the intermedium of the driving shaft 21, the cam 188 secured thereto, the roller 187, the arm 186, the pin 184, the link 177, the three-armed piece 171, 174, 175, the link 172, the arm 173 secured to the shaft 109, and the eccentrics 116 secured to the same shaft. At the same time the arm 256 by means of the link 271 is rotated clockwise, as seen in Fig. 3. This causes a rotation of the shaft 140, the catch members 144, and the catch discs 146 in the same direction and in this movement the discs 146 due to the engagement of their surface 135 with the abutment tend to bring the gear wheels 141 with them. In the example given said tendency is suppressed in respect to all of the wheels 141 except the two wheels furthest to the right in as much as the projection 118 of the corresponding wheels 108 already bears against the projection 122 of the locking levers 121, locked by the locking beam 309. In the first two units of the printing device as counted from the right the movement is transmitted from the toothed wheels 141, over the racks 114, the wheels 111, and the intermediate wheels 110 to the wheels 108, the movement being continued, until the projection 118 of the two gear wheels 108 furthest to the right strikes the projection 122 of the respective locking levers 121, that is to say, the first rack 114 is moved downwards a distance corresponding to two teeth, because the first gear wheel 108 was set on the digit 2 and the rotation as above stated, takes place in the opposite direction to that above referred to, whereas the second rack 114 as counted from the right is moved downwards a distance corresponding to one tooth, because the respective toothed wheel 108 was set on 1. The remaining racks 114 will not be actuated, and the corresponding limiting discs 146 will be turned idle against the action of the springs 145. At the same time the first two type heads 143 as counted from the right are set correspondingly, that is to say, the first type head is set on 2 and the second on 1. The number 12 is then printed in the manner above set forth and the parts are returned to normal. In this restoration the springs 145 are first released due to the rotation of the shaft 140 in counter clockwise direction, as seen in Fig. 3, through the intermedium of the arm 253 and the link 271, whereupon the discs 146 associated with the two toothed wheels 141 operated are returned to normal during the continued rotation of the shaft 140 by means of the arm 256, the link 257, the roller 263, and the cam surface 262, and finally all parts are restored to normal position under the control of the bell crank lever 265 when the shaft 140 is restored to normal.

The operation of the accumulating-recording mechanism, when the machine is used for subtraction, is the same as that described above, because upon depression of the subtraction key the number set up on the key board will be transmitted to the driving wheels 43 from the spindles 13 with reversed

direction of the drum 12. Multiplication and division are a repetition of addition and subtraction, respectively.

I claim:

1. In a calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, a series of gear wheels mounted in said carrier adapted to be actuated by the item mechanism, a series of vertically movable type bars, a series of vertically movable racks mounted in the carrier and adapted to engage said gear wheels, and means to connect said type bars with said racks, respectively and simultaneously move connected racks and bars in opposite directions.

2. In a calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier, one of said series of gear wheels being adapted to be actuated by the item mechanism, a wheel of one series being connected to rotate in unison with a companion wheel of the other series, mechanism to shift the carrier, a series of swingable and vertically movable racks, a series of vertically movable type members in opposite operating relation to said racks, and means to connect said series of racks with either of the series of gear wheels.

3. In a calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier, one of said series of gear wheels being adapted to be actuated by the item mechanism, a third series of gear wheels also mounted in said carrier and in permanent engagement with the two first-mentioned series of gear wheels, a series of swingable and vertically movable racks, a series of vertically movable type members, means to move said type members and said racks in opposite relation, and means to connect said series of racks with either of the two first-mentioned series of toothed wheels.

4. A calculating machine comprising item mechanism, actuating mechanism including a handle, a swingable carrier, two series of gear wheels mounted in said carrier and connected to rotate in unison, means controlled by the handle to temporarily connect one of said two series of gear wheels with the item mechanism on the forward stroke of said handle, during usual counting operations, and to break said connection on turning the handle further in forward direction, a series of swingable and vertically movable racks, a series of vertically movable type members permanently geared to said series of racks, and means to connect said series of racks with either of the series of gear wheels.

5. In a calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier connected to rotate in unison, one of said two series of gear wheels being movable into engagement with the item mechanism by swinging said carrier, means to lock said carrier in disengaged position, a series of swingable and vertically movable racks, a series of vertically movable type members in permanent geared relation with said series of racks, and means to connect said series of racks with either series of toothed wheels.

6. In a calculating machine, the combination with item mechanism and setting mechanism including a non-print key, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier and connected to rotate in unison, one of said two series of toothed wheels being movable into engagement with the item mechanism by swinging said carrier, means controlled by the non-print key to lock said carrier in disengaged position, a series of swingable and vertically movable racks, a series of vertically movable type members permanently geared with said series of racks, and means to connect said series of racks with either series of gear wheels.

7. In a calculating machine, the combination with item mechanism and setting mechanism including a total key, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier and connected to rotate in unison, one of said two series of gear wheels being movable into engagement with the item mechanism by swinging the carrier, means controlled by the total key to lock said carrier in disengaged position, a series of swingable and vertically movable racks, a series of vertically movable type members geared to said series of racks, and means to connect said series of racks with either series of gear wheels.

8. In a calculating machine, the combination with item mechanism and setting mechanism including a non-print key and a total key, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier, each wheel of one series being connected to rotate in unison with a wheel of the other series, one of said two series of gear wheels being movable into engagement with the item mechanism by swinging the carrier, means controlled by the non-print key and by the total key to lock said carrier in disengaged position, a series of swingable and vertically movable racks, a series of vertically movable type members connected to said series of racks, and means to connect said series of racks with either series of gear wheels.

9. In a calculating machine, the combination with item mechanism, of accumulating-

recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier, a wheel of one series being connected to rotate in unison with a companion wheel of the other series, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks disposed between said two series of gear wheels and engageable with either of said series of gear wheels, a third series of gear wheels engaging said racks, and a series of vertically movable type members in permanent engagement with said series of gear wheels.

10. In a ten-key-operated calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier, a wheel of one series being connected to rotate in unison with a companion wheel of the other series, one of said two series of gear wheels being engageable with the item mechanism, a series of vertically movable and swingable racks, means to positively guide said racks in their reciprocating as well as in their swinging motion, a series of vertically movable type members in permanent geared relation with said series of racks, and means to move said series of racks into engagement with either series of gear wheels.

11. In a calculating machine, the combination with item mechanism and actuating mechanism including a handle, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels in said carrier arranged for simultaneous rotation, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks mounted in said carrier, a series of vertically movable type members permanently geared to said series of racks, and means controlled by the handle to connect said series of racks with either series of gear wheels.

12. In a ten-key-operated calculating machine, the combination with item mechanism and means to set the machine for different modes of calculation, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier arranged for simultaneous rotation, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, a series of vertically movable type, members in permanent geared relation with said series of racks, and means controlled by said machine setting means to connect said series of racks with either series of gear wheels.

13. In a ten-key-operated calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier for simultaneous rotation, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, a series of vertically movable type members in permanent geared connection with said series of racks, and means including an eccentric adapted to swing said series of racks into engagement with either series of gear wheels.

14. In a ten-key-operated calculating machine, the combination with item mechanism, actuating mechanism including a handle, and means to set the machine for different modes of calculation, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels in said carrier in permanent geared connection with each other, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, a series of vertically movable type members in permanent geared connection with said series of racks, and an eccentric for each of the racks adapted to be controlled by said machine setting means and, on operation of the handle, to swing said racks into engagement with either series of gear wheels.

15. In a calculating machine, the combination with item mechanism and setting mechanism including a total key, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier and in permanent geared connection with each other, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, a series of vertically movable type members in permanent geared connection with said series of racks, and means controlled by said total key to connect said series of racks with either series of gear wheels.

16. In a calculating machine, item mechanism, actuating mechanism including a handle, setting mechanism including a total key, and accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier and in permanent geared connection with each other, one of said two series of gear wheels being engageable with the item mechanism under influence of the handle, a series of swingable and vertically movable racks, a series of vertically movable type members in permanent geared connection with said series of racks, and means to connect said series of racks with either series of gear wheels, said means being actuated by the actuating mechanism and controlled by the setting mechanism so that the racks are moved, upon operation of the handle, into engagement with one of the series of gear wheels when the total key is depressed and with the other series of gear wheels when said key is not depressed.

17. In a calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks mounted in said carrier, a series of vertically movable type members in permanent geared connection with said series of racks, means mounted in said carrier for the carrying of tens between the racks and gear wheels, and means to connect said series of racks with either series of gear wheels.

18. In a calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks mounted in said carrier, a series of vertically movable type members in permanent geared relation with said series of racks, tens carrying means, and means to first connect said series of racks with one series of gear wheels to set said type members in accordance with the item mechanism and then to connect said racks with the other series of gear wheels for performing the carrying of tens.

19. In a calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks mounted in said carrier, a series of vertically movable type members in permanent geared connection with said series of racks, tens carrying means mounted in said carrier and operating on said type members, and means to connect said series of racks with either series of gear wheels.

20. In a ten-key-operated calculating machine, the combination with item mechanism and actuating mechanism including a handle, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, a series of vertically movable type members in permanent geared connection with said series of racks, tens carrying means, means controlled by the handle and adapted to move said series of racks into engagement with one series of gear wheels to set said type members in accordance with an item set up in the item mechanism, and means controlled by the handle to move said series of racks into engagement with the other series of gear wheels for performing the carrying of tens.

21. In a calculating machine, the combination with item mechanism and actuating mechanism including a handle, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, a series of vertically movable type members in permanent geared connection with said series of racks, tens carrying means, means controlled by the handle and adapted to be operated on the forward stroke of said handle to move said series of racks into engagement with the one series of gear wheels to set said type members in accordance with an item set up in the item mechanism, and means controlled by the handle, adapted to be operated on the backward stroke thereof, to move said series of racks into engagement with the other series of gear wheels for the carrying of tens.

22. In a calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, a series of vertically movable type members in permanent geared connection with said series of racks, means to connect said series of racks with either series of gear wheels, and tens carrying means mounted in the carrier and adapted to operate in both directions of rotation of the gear wheels.

23. In a calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, a series of vertically movable type members in permanent geared connection with said series of racks, means to connect said series of racks with either series of gear wheels, and tens carrying means mounted in the carrier and adapted to be controlled by the gear wheels.

24. In a calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared con-

nection with each other, one of said two series of toothed wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, a series of vertically movable type members in permanent geared connection with said series of racks, means to connect said series of racks with either series of gear wheels, and tens carrying means comprising a series of levers rotatably mounted in the carrier and adapted to be operated by the gear wheels.

25. In a calculating machine, the combination with item mechanism, of accumuating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, a projection on each of the gear wheels of the one series, one of said series of toothed wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, a series of vertically movable type members in permanent geared connection with said series of racks, means to connect said series of racks with either series of gear wheels, and tens carrying means comprising a series of spring-actuated levers rotatably mounted in the carrier and adapted to cooperate with the projections on the gear wheels.

26. In a calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, a series of vertically movable type members in permanent geared connection with said series of racks, means to connect said series of racks with either series of gear wheels, tens carrying means comprising a series of levers rotatably mounted in the carrier and adapted to be operated by the gear wheels, and means to lock said levers in operative and inoperative positions.

27. In a ten-key operated calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, a series of vertically movable type members in permanent geared connection with said series of racks, means to connect said series of racks with either series of gear wheels, tens carrying means comprising a series of levers rotatably mounted in the carrier and adapted to be operated by the gear wheels, means to lock said levers in operative and inoperative positions, and means to release said locking means.

28. In a calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, one of said two series of toothed wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, a series of vertically movable type members, a series of intermediate wheels in permanent engagement with said series of racks and said series of type members, and means to connect said series of racks with either series of gear wheels.

29. In a calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, a series of vertically movable type members, a series of intermediate wheels in permanent engagement with said series of racks and said series of type members, means to connect said series of racks with either series of gear wheels, and power transmitting means for rotating said intermediate wheels and adapted to actuate the racks and the type members.

30. In a calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, a series of vertically movable type members, a series of loosely journalled intermediate wheels in permanent engagement with said series of racks and said series of type members, and means to connect said series of racks with either series of gear wheels.

31. In a calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, a series of vertically movable type members, means to maintain said members in permanent geared connection with said series of racks, tens carrying means operatively associated with each rack, the means connecting each rack with corresponding type member being adapted to be controlled by the tens carrying means of the rack next to the right, and means to connect said series of racks with either series of gear wheels.

32. In a calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, tens carrying means operatively associated with each rack, a series of vertically movable type members, a series of intermediate wheels in permanent engagement with said series of racks and with said series of type members, abutting means for each of said intermediate wheels, each of said abutting means being adapted to be controlled by the tens carrying means of the rack next to the right, and means to connect said series of racks with either series of gear wheels.

33. In a calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, tens carrying means operatively associated with each rack and comprising a pawl adapted to be controlled by corresponding gear wheels and normally limiting the movement in one direction of the intermediate wheel nearest to the left, a series of vertically movable type members, a series of intermediate wheels in permanent engagement with said series of racks and with said series of type members, a projection on each of said intermediate wheels cooperating with said pawls, and means to connect said series of racks with either series of gear wheels.

34. In a ten-key-operated calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, a series of vertically movable type members, means to maintain said type members in permanent geared connection with said series of racks, tens carrying means combined with each rack and adapted to be controlled by the corresponding gear wheels, said tens carrying means comprising means to permit the movement of the type member next to the left one step in one direction, and means to connect said series of racks with either series of gear wheels.

35. In a calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, tens carrying means operatively associated with each rack, a series of vertically movable type members, a series of intermediate wheels in permanent engagement with said series of racks and with said series of type members, means operatively associated with each intermediate wheel to re-set said wheel to normal position and to perform the carrying of tens, and means to connect said series of racks with either series of gear wheels.

36. In a calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, tens carrying means operatively associated with each rack, a series of vertically movable type members, a series of intermediate wheels in permanent engagement with said series of racks and with said series of type members, means for limiting the rotation of each of said intermediate wheels in both directions, said limiting means being adapted to be controlled by the tens carrying means of the rack nearest to the right, and means to connect said series of racks with either series of gear wheels.

37. In a ten-key-operated calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, tens carrying means operatively associated with each rack, a series of vertically movable type members, a shaft, a series of intermediate wheels rotatably mounted on said shaft and in permanent engagement with said series of racks and with said series of type members, power transmitting means operatively associated with each of said intermediate wheels and adapted to actuate the racks and the type members, each of said power transmitting means comprising a catch disc loosely mounted on said shaft and connected by a spring with the shaft, the intermediate wheels being adapted to limit the rotation of said discs in both directions, and means to connect said series of racks with either series of gear wheels.

38. In a calculating machine, the combination with item mechanism and actuating mechanism including a handle, of accumu-

lating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, a series of vertically movable type members, a shaft, a series of intermediate wheels loosely mounted thereon in permanent engagement with said series of racks and with said series of type members, cam-actuated means connected with the handle to turn said shaft in one direction to re-set the racks and the type members, and means to connect said series of racks with either series of gear wheels.

39. In a calculating machine, the combination with item mechanism, actuating mechanism including a handle and setting means including a total key, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, tens carrying means operatively associated with each rack, a series of vertically movable type members, a shaft, a series of intermediate wheels loosely mounted on said shaft in permanent engagement with said series of racks and with said series of type members, means controlled by the total key to transmit the movement from the handle to said shaft, and means to connect said series of racks with either series of gear wheels.

40. In a ten-key-operated calculating machine, the combination with item mechanism, actuating mechanism including a handle and setting mechanism including a total key, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, one of said two series of gear wheels being connected with the item mechanism, a series of swingable and vertically movable racks, a series of vertically movable type members, a shaft, a series of intermediate wheels loosely mounted on said shaft in permanent engagement with said series of racks and with said series of type members, means to transmit the movement of the handle to said shaft, said transmitting means being controlled by the total key in such manner that on depressing the total key the direction of rotation of the shaft is reversed, and means to connect said series of racks with either series of toothed wheels.

41. In a calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks normally out of engagement with said gear wheels, a series of vertically movable type members in permanent geared connection with said racks, means to connect said series of racks with either series of gear wheels, and means to lock the gear wheels.

42. In a ten-key-operated calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent engagement with each other, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks normally out of engagement with said gear wheels, a series of vertically movable type members in permanent geared connection with said racks, means to swing said series of racks into engagement with either series of gear wheels, and means to lock the gear wheels, said locking means being controlled by the rack swinging means.

43. In a ten-key-operated calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a series of swingably mounted gear wheels, said gear wheels being engageable with the item mechanism, a series of vertically movable type members, a series of vertically movable racks mounted to engage said gear wheels, means to connect said series of type members with said series of racks and move connected racks and type members in opposite directions, and means to adjust the mutual position of the teeth of the several gear wheels.

44. In a calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, means to cause said two series of toothed wheels to be driven from the item mechanism, a series of swingable and vertically movable racks, a series of vertically movable type members in permanent geared connection with said racks, means to connect said series of racks with either series of gear wheels, and means to adjust the mutual position of the teeth of the several racks.

45. In a calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, a series of vertically

movable type members, a series of intermediate wheels in permanent engagement with said racks and said type members, means to connect said series of racks with either series of gear wheels, and means to adjust the mutual position of the teeth of the several wheels of the series of intermediate wheels.

46. In a ten-key-operated calculating machine, the combination of item mechanism and setting mechanism including a total key, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, tens carrying means operatively associated with each rack, a series of vertically movable type members in permanent geared connection with said racks, means controlled by the total key to retain the tens carrying means in operative position, and means to connect said series of racks with either series of gear wheels.

47. In a ten-key-operated calculating machine, the combination with item mechanism and setting mechanism including a total key, of accumulating-recording mechanism comprising a swingable carrier, two series of gear wheels mounted in said carrier in permanent geared connection with each other, one of said two series of gear wheels being engageable with the item mechanism, a series of swingable and vertically movable racks, tens carrying means operatively associated with each rack, each tens carrying means comprising a member swingably mounted in the carrier and formed with a notch, a series of vertically movable type members in permanent engagement with said racks, means controlled by the total key to retain said tens carrying members in operative position, said retaining means comprising a locking beam adapted to engage the notches of said carrying members, and means to connect said series of racks with either series of gear wheels.

48. In a ten-key-operated calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a series of swingably mounted gear wheels, said series of gear wheels being engageable with said item mechanism, a series of vertically movable type members, a series of vertically movable racks mounted to engage said gear wheels, means to connect said series of type members with said series of racks and move connected type members and racks in opposite directions, printing means comprising a series of hammers cooperating with the type members and means for normally holding said hammers out of engagement with the said type members.

49. In a ten-key-operated calculating machine, the combination with item mechanism, of accumulating-recording mechanism comprising a series of swingably mounted gear wheels, said gear wheels being engageable with the item mechanism, a series of vertically movable type members, a series of vertically movable racks mounted to engage said gear wheels, means to connect said type members with said series of racks and move connected type members and racks in opposite directions, printing means comprising a series of hammers cooperating with the series of type members, and means operatively associated with each hammer and controlled by the corresponding type member for normally locking the hammer in inoperative position.

50. In a ten-key-operated calculating machine, the combination with item mechanism and actuating mechanism including a handle, of accumulating-recording mechanism comprising a series of swingably mounted gear wheels, said series of gear wheels being engageable with said item mechanism, a series of vertically movable type members, a series of vertically movable racks mounted to engage said gear wheels, means to connect said series of type members with said series of racks and move connected type members and racks in opposite directions, printing means comprising a series of hammers cooperating with the type members, means controlled by the type members for normally locking the hammers in inoperative position, and means controlled by the handle for releasing the hammers.

51. In a ten-key operated calculating machine, the combination with item mechanism and setting mechanism including a handle, of accumulating-recording mechanism comprising a series of swingably mounted gear wheels, said gear wheels being engageable with the item mechanism, a series of vertically movable type members, a series of vertically movable racks mounted to engage said gear wheels, means to connect said type members with said series of racks and move connected type members and racks in opposite directions, printing means comprising a series of spring-actuated hammers cooperating with the series of type members, means operatively associated with each hammer and controlled by the corresponding type member for normally locking the hammer in inoperative position, and means common to all of the hammers and controlled by the handle for releasing the hammer.

52. In a calculating machine, the combination with item mechanism, of a type bar, a rack oppositely movable to said bar and opposing the movement thereof, a device between them for transmitting movements between the rack and bar and vice versa, and mechanism engageable by both the rack and item mechanism to position the rack in accordance with the item set up.

53. In a calculating machine, the combina-

tion with item mechanism, of a type bar, a rack oppositely movable to said bar and opposing the movement thereof, a device between them for transmitting movements between the rack and bar and vice versa, mechanism engageable with the item mechanism to position the rack in accordance with the item set up and means for actuating said device for returning the rack and bar to zero position and for operating said rack bar one step to transfer one digit to the next adjacent mechanism to the left and for reversing said mechanism upon total printing.

In testimony that I claim the foregoing as my invention, I have signed my name.

CONRAD LUTTROPP.